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JANUARY 1931

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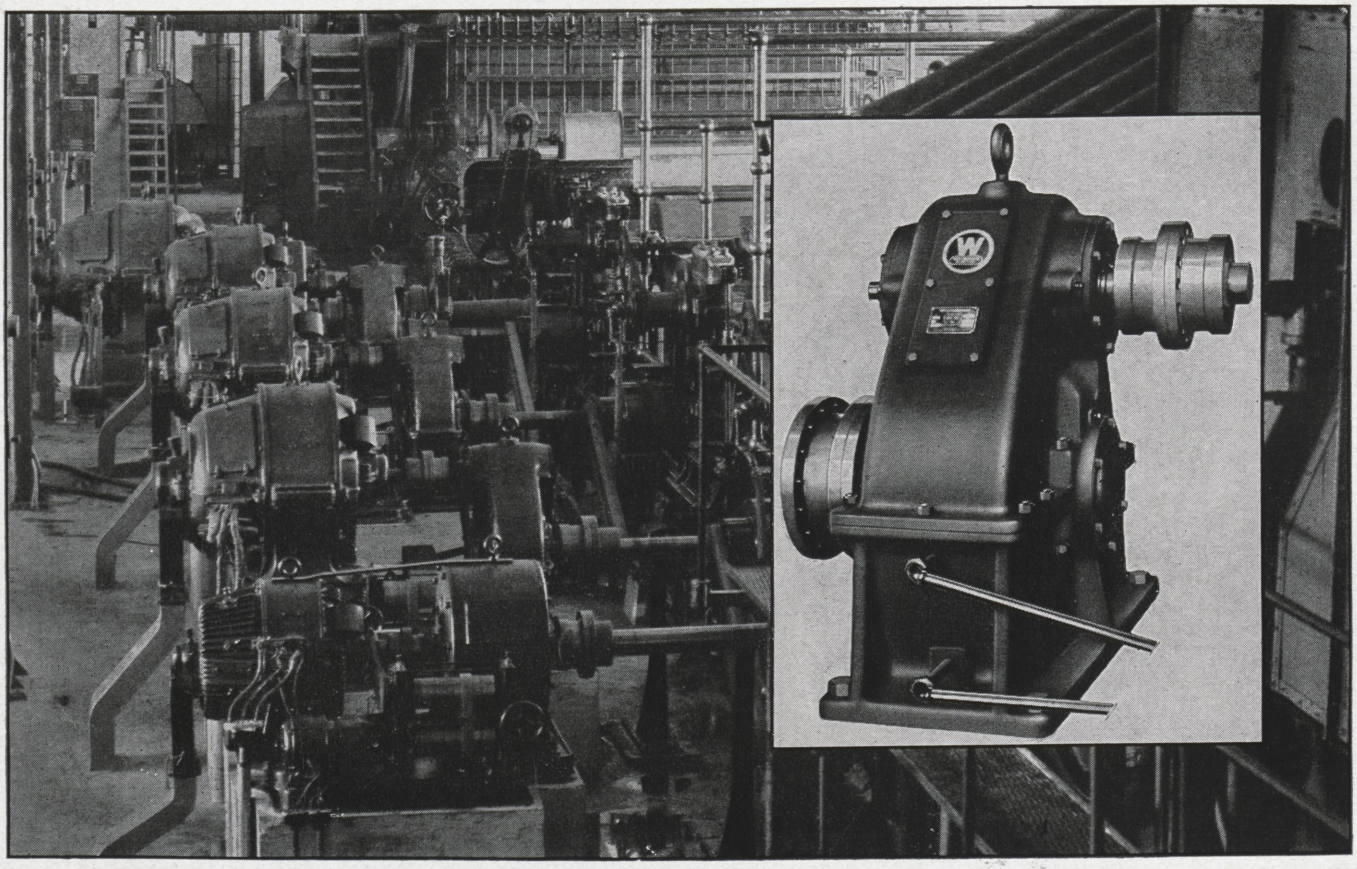

These Timken Bearings Have Run 70 Times the Life of the Average Automobile

The pinion bearings in the 6 Westinghouse-Nuttall gear reduction units at the Washington Pulp and Paper Company have each rolled up the enormous total of over 2,338,000,000 revolutions, and a recent check-up shows that they are good for many millions more.

Loaded 100% of their Timken catalogue rating, they have averaged 6¼ days per week, 24 hours a day since they were installed in April, 1923.

The total distance traveled by each of these bearings is the equivalent of driving an automobile more than 3,500,000 miles, whereas the average automobile travels but 50,000 miles during its entire life.

A worthy tribute to Timken stamina! Won't you want this same unequalled endurance in the machinery you design, recommend or buy? The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**

THE ROSE TECHNIC

Vol. XXXX

Number 4

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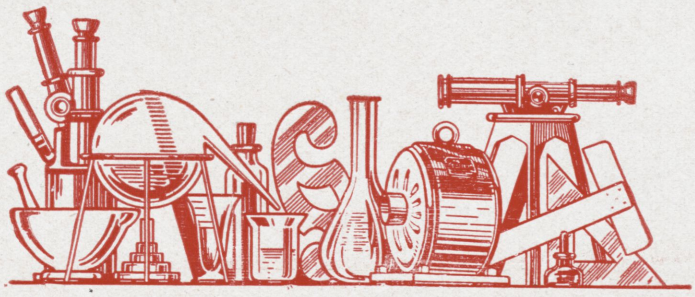
THE ENGINEER ANTICIPATES THE FUTURE

By R. M. CLARK



THE ROSE TECHNIC

THE TECHNICAL JOURNAL OF THE ROSE POLYTECHNIC INSTITUTE

Volume XXXX JANUARY 1931 Number 4

The Scope of Engineering Education

The Broadening Effects of Engineering Education are Demonstrated by Statistics

Donald B. Prentice, President-Elect

Are engineers unwilling and unqualified to participate in the political and cultural life of their communities? Does the engineering student suffer from overspecialization? These two questions represent a problem of vital importance to the engineer. Dean Prentice has expressed his views on the subject in this article reprinted from Mechanical Engineering. The importance of the subject and the fact that its author is to be the next president of Rose make the article doubly interesting to Technic readers. —The Editors.

A year ago an important article in MECHANICAL ENGINEERING presented in convincing statistical manner the broad activities of engineers and manufacturers whose names were recorded in "Who's Who in America." There was ample refutation of the frequently expressed, but obviously unjust, charge that the engineer is narrow, and both unwilling and unqualified to participate in the political and cultural life of his community. Evidence is now available to show that this catholic interest of the engineer does not develop in later years, but is part of his equipment when he leaves college. We have been led to believe that the arts curriculum of our colleges gives breadth of view and variety of interest. The engineering courses, we have been told, are too utilitarian, and the engineering student suffers from overspecialization. We have received recently definite proof that this is not true.

Carnegie Study

At the invitation of the Association of College Presidents of Pennsylvania and the Department of Public Instruction of the Commonwealth, the Carnegie Foundation for the Advancement of Teaching is making a most elaborate study of secondary and collegiate education in this state. Dr. W. S. Learned is general director of the program, and Dr. Ben Wood, of Columbia, has supervised the construction of the examinations.

An important part of the study was a comprehensive examination in all fields of knowledge to measure the content of the students' minds. This test of approximately 3500 questions, requiring twelve hours, was taken by all the seniors in 49 colleges, universities, and normal schools in Pennsylvania. There has just been made available an analysis of the results of this examination on the basis of a division into groups according to the major subject of study. There were several small groups majoring in subjects such as zoology, German, sociology, etc., but only nine groups comprising more than one hundred students each, thus making their averages of statistical importance. In the order of size these groups are: English, 964; Economics, 944; Engineering, 467; Chemistry, 418; Education, 278; History, 257; French, 148; Mathematics, 122; Household Arts, 101.

The examination questions were divided into three major fields: literature and fine arts, social science, and natural science. It would be expected that engineers

(Continued to page 24)

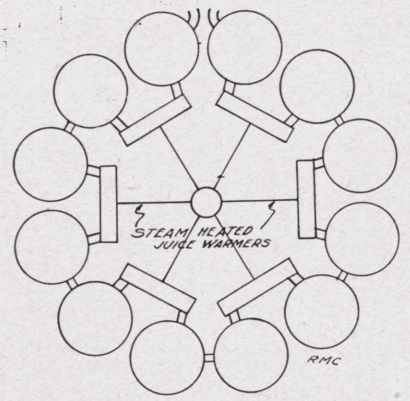
Beet Sugar in the U. S. and Germany

The Extraction of Sugar from Beets is a Highly Developed Industry

A. T. Child, Associate Professor of Chemical Engineering

Few people realize just what processes are utilized in manufacturing the very common substance, sugar. During his recent trip to Europe Professor Child had the pleasure of visiting various chemical plants, among which was a German sugar refinery. We are pleased to present his article based in part on that visit.

—The Editors.



Beet Sugar is Recovered from the Thinly Sliced Beets by Successive Extraction with Hot Water in a Battery of "Diffusers."

Historical

It is a matter of common knowledge that practically all the sugar we use for food comes either from the sugar cane or from the sugar beet. Written record of the sugar cane dates back to the fifth century A. D. During the succeeding centuries the culture of the sugar cane spread widely thru tropical countries. The control of the sugar trade was bitterly contested by England, Holland and Venice. Sugar cane raising and the development of slavery in this country were closely associated.

The extraction of sugar from the sugar beet is a much younger industry. A chemist named Andrew Margraff was able to extract 3% of sucrose from sugar beets in 1747. A pupil of his named Francis Karl Achard secured the patronage of Frederick William III of Prussia. Fifty-two years after Margraff's first experiments were made the first beet sugar plant was put up in Silesia. For a long time beet sugar made little headway against the cane sugar. During the Napoleonic wars, however, England blockaded all the continental ports and beet sugar got its chance. Both France and Germany were forced to turn to beet sugar. Germany with its gift for scientific research and organization developed a highly scientific technique. At the outbreak of the Great War Germany was the biggest producer in the world of beet sugar. A man named David Child tried to make beet sugar in the United States in 1838, but we find little real commercial progress until the government provided tariff protection in 1897. At present we have over a hundred plants in the United States producing beet sugar. Owing to depressed market conditions many are in the hands of receivers, but are allowed to operate. The leading states in this industry are Utah, Colorado, Michigan, California, Montana and Nebraska.

Sugar from the beet is the same chemically as that from the cane. Altho the government has shown by a long series of experiments that no real difference exists between the two kinds of sugar, housewives maintain that it does not behave the same in some operations, jelly-making for instance. Because of this prejudice, beet sugar sells for twenty-five cents less per hundred pounds than cane sugar. In the vicinity of Terre Haute, we use about 20% beet sugar, part coming from Colorado, but most of it from Michigan.

Statistical Data

Like so many other food commodities, sugar is low in price, due to overproduction. The New York base price is about $4.55 for beet and $4.75 for cane sugar per 100 pounds.

The following statistics were furnished by the Foodstuffs Division of the Department of Commerce.

Total consumption of sugar in the United States for 1929: 6,508,-297 tons.

Total beet sugar.....959,437 tons

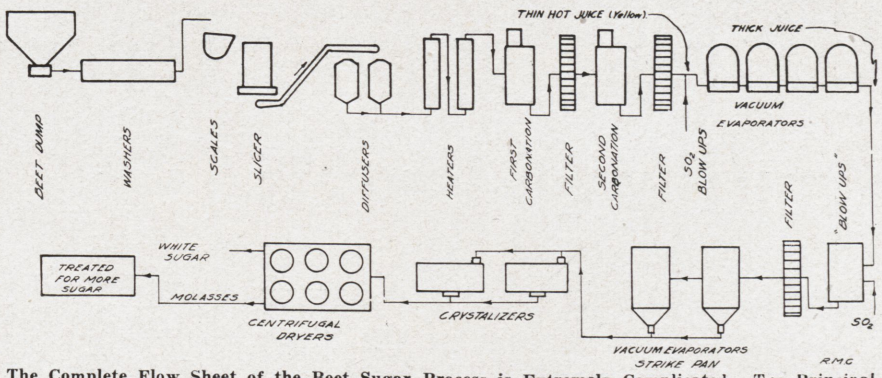
Percentage of total consumption supplied by:	Percentage of total
Domestic Cane.....	2.71
Domestic Beet.....	14.74
Insular possessions (cane)..	30.40
Total domestic, no-dutiable and foreign	47.87
Cuba 20% tariff differential-cane	51.88
Foreign, full duty paying	.25

American Beet Sugar Practice

It is comparatively easy to extract sugar from the sugar cane. The ripe cane is crushed with very heavy rolls and then the sugar extracted with hot water. The sugar beet however contains far more impurities which can be dissolved by hot water, especially if the beet is finely cut up. On account of the presence of these soluble impurities the Germans have been obliged to spend a great deal of effort in developing a scientific technique. Beet sugar practice the world over is based on their methods, even cane sugar practice has adopted many details from beet sugar methods.

Good beets often contain about 16%, about the same percentage of sugar as is found in the cane. The beet must be gathered when the sugar is stored in maximum quantity in its flesh. The beets can be

stored quite a time in open sheds or silos, but the industry is decidedly seasonal, many plants being idle a large part of the year. In France and Belgium I saw beets stored in long earth-covered piles in the fields. The beets arrive at the mill either by motor conveyance or railroad. From this point the process is as indicated in the abridged flow sheet presented below.



The Complete Flow Sheet of the Beet Sugar Process is Extremely Complicated. The Principal Successive Steps are Shown in the Diagram.

After the beets are washed and thinly sliced they are ready to be extracted with hot water. This process is carried out in a battery of "diffusers" arranged in groups of ten or more, like the diagram shown in the text. The water must be kept at a temperature of 80 degrees centigrade. Experiment has shown that at this temperature the sugar will be dissolved, but the beet will not readily be reduced to a soft pulp and thus cause the dissolving of undesirable impurities. The sugar is enclosed in cells as the starch is in the potato. The hot water extracts the sugar by a form of osmosis, a principle understandable by all engineers who have taken freshman chemistry at Rose. We will suppose that a diffuser has been emptied of its charge of exhausted pulp and refilled with fresh beet slices or cosettes. Hot water is next run in till the diffuser is entirely full and then connected in series with its neighbor. The diffusers are small closed steel tanks each having a pipe lead-in from the bottom of one to the top of the next. It is easily understood that you can connect the whole station in series and circulate the sugar solution. Every fifteen minutes approximately a fresh diffuser is recharged and a portion of the rich juice drawn off and sent on to the next step in the process.

Purification of the Juice

By means of successive additions of lime followed by treatments with carbon dioxide most of the impurities can be precipitated and separated from the juice by means of various types of filter presses. The juice is now ready to be treated with sulphur dioxide which precipitates more impurities, helps bleach the sugar, and neutralize the alkalinity. Another filtration follows. The next step is evaporation in the very efficient multiple vacuum pan evaporators. Always two or more are connected in series and their product is a thick dark rather dirty looking juice, which must be again treated with sulphur dioxide, if the mill wishes to make white granulated sugar. Another filtration and the thick clear syrup is ready for final evaporation to crystal in the single vacuum pans or strike pans as they are called in sugar mill terms. The molasses mixed with the sugar is separated from the sugar in centrifugals, and the sugar washed pure white with pure thin syrup. It only remains now to dry and granulate and package the sugar for market. Some may be moulded and cut for lump sugar or some may be ground fine for confectioners. The molasses is generally treated for a second sugar, and the pulp used for cattle food. In Germany the pulp is sometimes treated for potash.

Last winter while we were in Berlin I remembered that Germany was preëminent in the beet sugar industry, and determined to make an attempt to visit one of their plants.

Fortunately before we left the States I went to my good friend Dr. Elwood Hendrick. Dr. Hendrick has recently passed on leaving hosts of friends and a record of great achievement. He gave me personal letters of introduction and arranged to have Dr. Stephen Duggan of the International Institute of Education give me more letters. Dr. Duggan fixed me up with letters to men and institutions in every country we visited. Everyone who goes over to Europe to study should get in touch with Dr. Duggan's organization. The consuls and trade commissioners are very helpful also.

Trip Through German Refinery

In arranging for my proposed visit to a German beet sugar plant these connections were absolutely essential. I first went to the Berlin branch of Dr. Duggan's organization, the Amerika Institut. They gave me a letter of introduction to the Director of the Industrial Relations Service who took complete charge of the arrangements for my visit.

All these formalities fixed up we set forth one frosty morning in early March and boarded the Cologne express. The country you pass thru is very flat. Some of it is given over to raising pine timber. The most up-to-date forestry methods are observable everywhere. Everywhere refuse is cleaned up in neat piles. Sugar beets are raised in quantities on the small flat farms. The land is light and must be well fertilized. Strange to say these farmers prefer the old Chile nitrate to the recent synthetic German fertilizers.

We left the express at a little station named Stendahl where we were met by an immaculate limousine and chauffeur and were driven to the sugar refinery at the little village of Tangermuende. Arrived at the plant we were received most cordially by the high officials. The firm name is Meyer & Sohn and they have been refining beet sugar right there for many, many years.

(Continued to page 22)

Critical Points in Tapered Cantilever Beams

The Position of the Point of Maximum Stress is a Function of the Taper and the Dimension of the Section at the Center of the Load System.

Allen G. Stimson, m., '31

The maximum stress due to bending in a cantilever beam of circular section and uniform taper occurs at the point where the diameter is fifty per cent larger than that at the center of the load system. In a beam of rectangular section with thickness constant and width variable the critical point is at the section where the width is twice that at the center of the load system. These two cases have been considered because they are typical and have practical applications.

General Considerations

Neglecting the stress due to shear, a cantilever beam of uniform strength would have the shape of a cubic parabola as shown by the curve in figure 1. The envelope of this paraboloid would be the frustum of a cone such as the tapered beam considered in case I. The point at which the envelope is tangent to the paraboloid is the weakest point in the enveloping beam since the section of the beam is greater than the paraboloid at all other points. This point of tangency or critical point can be found by analytical geometry by writing equations for the parabola and the envelope and solving for the point of tangency. This solution involves such complicated algebraic processes that the method has not been presented in this manuscript since the problem can be solved much more expediently by use of the Differential Calculus.

Case I: Circular Section

The following nomenclature has been assumed in pursuing this investigation.

D = diameter of beam at any point in inches.
d = diameter of beam at center of load system in inches.
x = distance from center of load system to critical point in feet.
p = equivalent transverse load in pounds.
t = taper of beam in inches per foot.
z = section modulus.
$= \frac{\pi d^3}{32}$ for a circular section.
f = fiber stress due to bending.
M = bending moment produced by load in ft. lbs.

It is assumed that stresses due to shear be neglected.

From consideration of figure 2 it is evident that

$$D = d + tx$$

Since the bending moment is equal to the resisting moment $M = fz$

$$\text{or} \qquad 12px = f\frac{\pi D^3}{32}$$

$$= f\frac{\pi}{32}(d+tx)^3$$

Solving this equation for f

$$f = \frac{12 \cdot 32 \cdot px}{\pi(d+tx)^3}$$

Differentiating this expression with respect to x

$$\frac{df}{dx} = \frac{\pi(d+tx)^3 12 \cdot 32 \cdot p - 12 \cdot 32 \cdot px\,\pi 3(d+tx)^2 t}{\pi^2(d+tx)^6}$$

Equating this derivative to zero and solving for x

$$\frac{\pi(d+tx)^3 12 \cdot 32 \cdot p - 12 \cdot 32 \cdot px\,\pi 3(d+tx)^2 t}{\pi^2(d+tx)^6} = 0$$

$$(d+tx) - 3xt = 0$$

$$d - 2xt = 0$$

$$x = \frac{d}{2t}$$ at this point f is maximum.

Since $D = d + tx$

and $x = \frac{d}{2t}$

$$D = d + \frac{d}{2} = \tfrac{3}{2}d$$ at critical point.

That is, the diameter at the critical point is $\frac{3}{2}$ as large as or fifty per cent larger than at the center of the load system.

A very practical application of this formula is found in telephone poles. However, soon after the pole is set in the ground decay and the weakening effect due to moisture make the ground line the weakest point in the pole. Nevertheless, the initial stress at the critical point should be calculated in order that it will not be excessive. In short beams of small taper x may be greater than the length of the beam, in which case maximum stress will occur at point A.

Another Method

The above calculations determined the point at which the fiber stress was maximum. To prove that this critical point is at the point of tangency of the two curves the following analytical solution is offered. The mathematical principle involved is that since the curves are tangent their slopes are equal at that point. Hence, by equating the first derivatives the point of tangency may be found.

The equation of the cubic parabola in figure 4 is

$$x = KD_1^3$$

which is derived from the equality

$$12px = \frac{f\pi D^3}{32}$$

by considering $D_1 = \frac{D}{2}$ and $d_1 = \frac{d}{2}$ and $t_1 = \frac{t}{2}$

$$K = \frac{f\pi}{12 \cdot p \cdot 32 \cdot 8}$$

The slope of the tangential line which represents the edge of the beam with respect to the D_1 axis is found as follows:

$$tx = D_1 - d_1$$

$$x = \frac{D_1}{t_1} - \frac{d_1}{t_1}$$

$$\frac{dx}{dD_1} = \frac{1}{t_1}$$

which is equal to the slope of the curve $x = KD_1^3$ at the point of tangency.

$$\frac{dx}{dD_1} = 3KD_1^2$$

Equating the two derivatives.

$$3KD_1^2 = \frac{1}{t_1}$$

but $$K = \frac{x}{D_1^3}$$

$$3\frac{D_1^3 x}{D_1^3} = \frac{1}{t_1}$$

$$3t_1 x = D_1$$

$$= t_1 x + d_1$$

Therefore: $$x = \frac{d_1}{2t_1}$$

and $$D_1 = \tfrac{3}{2}d_1$$

Substituting $D = 2D_1$ and $t = 2t_1$ and $d = 2d_1$

$$x = \frac{d}{2t}$$

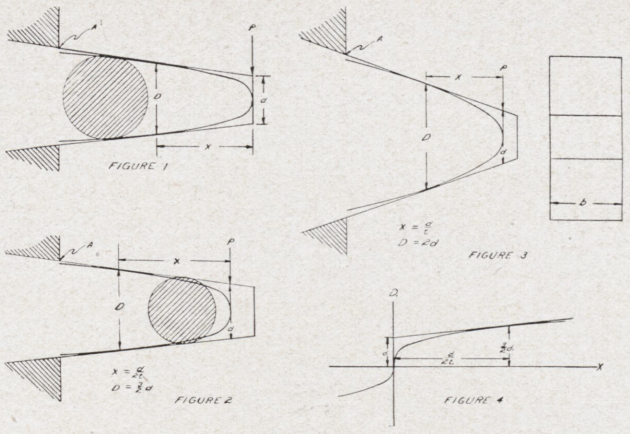
and $$D = \tfrac{3}{2}d$$

which result is identical with that achieved by the former method

Case II: Rectangular Section

Nomenclature:

b = constant thickness of section in inches.
D = width of section at any point.
d = width of section in inches at center of load system.
f = fiber stress due to bending.
z = section modulus.
$= \frac{bd^2}{6}$ for rectangular section.
M = bending moment produced by load in foot-pounds.
t = taper of width D in inches per foot.
x = distance from center of load system to critical point.



A Beam of Uniform Strength is Shown Enclosed by the Tapered Beam.

p = equivalent transverse load in pounds.

From consideration of Figure 3 it is evident that

$$D = d + tx$$

Since the bending moment is equal to the resisting moment.

$$M = fz$$

$$12px = f\frac{bD^2}{6}$$

$$= \frac{fb}{6}(d+tx)^2$$

Solving for f

$$f = \frac{6 \cdot 12 \cdot px}{b(d+tx)^2}$$

Differentiating this equation with respect to x

$$\frac{df}{dx} = \frac{b(d+tx)^2 6 \cdot 12 \cdot p - 6 \cdot 12 \cdot px\, b\, 2(d+tx)t}{b^2(d+tx)^4}$$

Equating this quantity to zero and solving for x

$$\frac{b(d+tx)^2 6 \cdot 12 \cdot p - 6 \cdot 12 \cdot px\, b \cdot 2(d+tx)t}{b^2(d+tx)^4} = 0$$

$$(d+tx) - x2t = 0$$

$$d - xt = 0$$

$$x = \frac{d}{t}$$ at this point f is maximum

Since $$D = d + tx$$

$D = d + d = 2d$ at critical point.

Therefore the width of the beam at the critical point is twice that at the center of the load system.

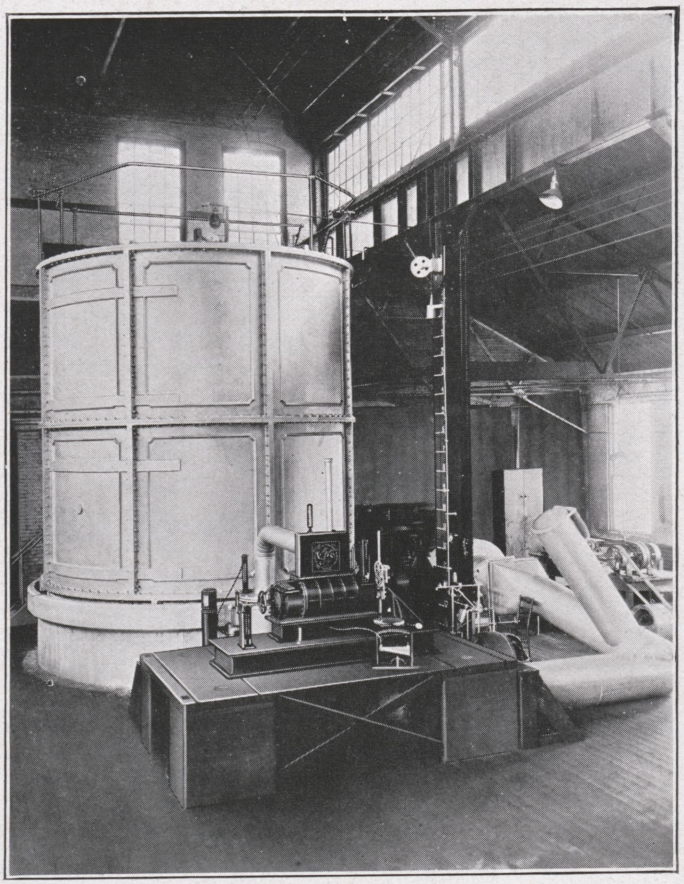
Discussion

A practical application of this formula is found in rack teeth. If x is greater than the depth of the tooth the maximum stress will occur at point A.

These calculations are the original work of the author and have not been compared with work of other writers nor checked by actual experiments. The writer would be glad to receive criticisms or discussions on the considerations discussed in this article. These calculations were originally made for the Engineering department of the Citizens Independent Telephone Co. of Terre Haute, Indiana.

World's Largest Gas Meter Prover

A High Capacity Tester is Developed in Response to Demands of Industry



The prover consists essentially of a piston inside a cylinder.

Franklin F. Bogardus, m., '24

Increasing use of gas in industry has focused attention on the metering of the large quantities used. The result has been the development of high capacity meters, theoretically correct, but actually not accurately checked. Recently, however, one company has constructed a machine which should eliminate all uncertainty in this field. —The editor.

The rapid growth of the gas industry has brought into use meters of much larger capacities than formerly used for station and distribution service. The continually growing use of gas in industrial processes has opened up a new field for gas, with the resultant demand for larger capacity industrial meters which, in many states, are required to be checked by the commission and officially sealed for accuracy. With present available methods for testing meters it was impossible to obtain an accurate check on these large capacity meters at their higher rates of flow. To provide a means of high capacity testing the Stacey Engineering Co. developed the 2800 cu. ft. dry piston type prover.

Details of Design

This prover, which is located at the Connersville, Indiana, plant, where the rotary positive displacement type meter is built, consists essentially of a piston working in a carefully calibrated cylinder. To obtain the desired volume essential for testing at high capacities it was necessary to obtain cylinder and piston, extremely large and yet which were not too large for accurate machining. The diameter of the cylinder was settled on as 16 ft. It was composed of 16 segments, which were bolted and pinned together, and then bored and ground to an accurate diameter.

The piston was cast in two sections, properly webbed to give rigidity, and these sections fastened on one end of a cast iron piston rod 12 in. in diameter and 19 ft. long. This rod passes through a stuffing box into a hydraulic chamber located beneath the prover and is raised by means of hydraulic pressure supplied by a three lobe cycloidal water pump. The weight of the piston and rod is such that it requires 150 lbs. per square inch hydraulic pressure on the rod to raise the piston assembly.

A clearance space of .002 of an inch was left between the circumference of the piston and the cylinder walls. To eliminate all possibility of leakage during the working stroke, a ring of packing was installed around the circumference of the piston, and on top of this packing a head of oil greater than the working pressure beneath the piston is maintained. This oil seal, also serving to lubricate the cylinder walls and prevent grabbing by the piston during its travel, is supplied by means of a motor driven pump which draws the oil from the reservoir located in the basement of the prover. The basement also houses a sump in which collects water from the hydraulic valves, a 24 in. rotary air valve, and various other valves, gauges, and thermometers. Connected to the bottom of the

(Continued to page 24)

Uses of the Cubical Parabola in Designing

Cantilever Beams of Circular Section and of Uniform Strength Have the Shape of the Cubic Parabola

Brent C. Jacob, '03

All who have studied calculus and analytics are or at least should be familiar with the cubical parabola. There are not many students, however, who know of the cubical parabola other than as the graph of the equation, $y^3=kx$. In this article Brent C. Jacob, Sr. explains some of the uses of the cubical parabola.

The cubical parabola is represented by the equation $y^3=kx$ where k is a constant. The square parabola is the one usually thought of when the word parabola is used and its equation is $y^2=2px$. It also is used in designing.

Fig. 1 shows a shaft such as is used on man trolleys for safety and as a jack to hold up one corner if necessary to change an axle bearing. The screw is usually set about one inch above the rail while traveling so if an axle breaks it will prevent the trolley from falling through the track. There are usually four of these shafts on a trolley, located near each corner. When used as a jack, the screw is moved down till it presses on the rail enough to take the weight of the trolley off the adjacent wheel. This reaction is represented by the pressure, P in Fig. 1. Then PB (=WL) is the bending moment at the support nearest the rail. The radius, R at this point, is determined by dividing PB by the desired fiber stress f, which gives the section modulus Z and $Z=\frac{\pi R^3}{4}$. As lightness of a moving load on a bridge is important, weight is reduced if the shaft is tapered as shown, yet it is essential to have no weak point. If shaped to a cubical parabola, it would have equal strength throughout but it would be too expensive in the shop so it is usually made as shown.

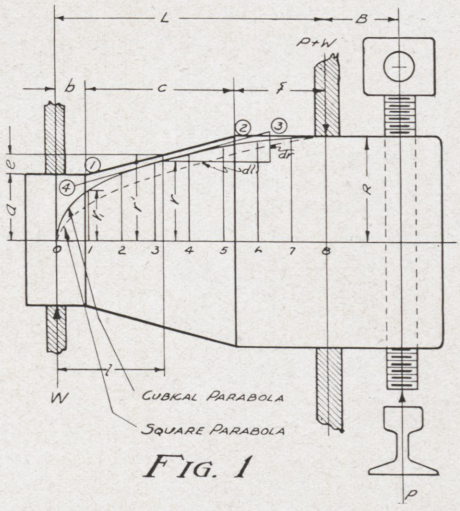


FIG. 1

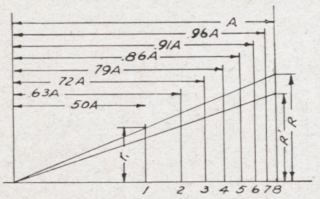


FIG. 2

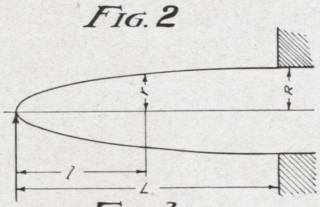


FIG. 3

Fig. 3 indicates a load, W applied to the end of a shaft L inches long and 2R inches diameter at the point of support. The weight of the shaft is neglected in the following case as though the shaft stood upright and the load were applied horizontally, and when its weight is a small percentage of the load it can be neglected. Let r=the radius at any distance l from W and f=fiber stress at point of support. When for fiber stress to be the same at any point $f=\frac{BM}{Z}=\frac{WL}{\frac{\pi R^3}{4}}=\frac{Wl}{\frac{\pi r^3}{4}}$ and $\frac{L}{R^3}=\frac{l}{r^3}$ or $r^3=R^3\frac{l}{L}$

$\therefore r=R\sqrt[3]{\frac{l}{L}}$. Letting r=y and l=x, the equation $r^3=R^3\frac{l}{L}$ becomes $y^3=kx$ where $k=\frac{R^3}{L}$. Thus it is seen that a round shaft of uniform strength has the shape of a cubical parabola, and if tapered with its dimensions always kept outside or larger than a cubical parabola, plotted from load to support, no point will be weaker than at the support.

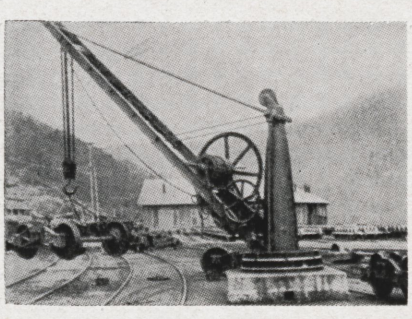


Fig. 4. Pillar Crane.

Plotting the Curve

If one has a slide rule with a beveled edge graduated in inches, it is easy to work it so as to readily plot this curve. Fig. 2 shows the idea. Let A equal the entire length of the beveled scale, say 10″ At a point 50% of the length A mark a line and label it 1. Mark the other points as shown in Fig. 2. The values in Fig. 2 are approximate to show the idea. The exact values are given by using the cube root of the quotient of the number divided by 8. Thus at number 6 instead of .91 the cube root of 6÷8 is .9086. The shaft in Fig. 1 has the distance L divided into 8 equal parts. (8 has been selected because by halving, it is easily divided). Perpendiculars are erected at the points 1 to 8. With the slide rule held down on the paper, draw a line along its length and mark off the points 0 to 8 and erect perpendiculars at these points as shown in Fig. 2. On perpendicular 8 lay off a distance R to the same scale as the drawing of Fig. 1. Join the top end of this with the point O and its intersections with the other perpendiculars give the value of the radii to be used on Fig. 1 to construct the cubical parabola.

If a tapered shaft has been designed without laying out a cubical parabola and not letting any part

(Continued to page 25)

Electric Arc Welding

Rejuvenation of Steel Industries

William O. Shofner, m., '32

Although still in its infancy, electric arc welding has already attacked the established methods and traditions of metal working, and manufacturers will do well to study its possibilities with an open mind and a firm determination to apply it to their own products.

Of the five general methods of welding, the electric arc method has proved itself most adaptable to manufacturing of all kinds, it being dependable as well as speedy and economical. The startling claims made for electric arc welding during the past year lead one to believe that the process is very complicated, requiring elaborate equipment and great technical skill for its operation. Such is not the case, for there is certainly nothing mystifying in the process. To begin with, "welding" is merely fusing together the parts to be joined by bringing them to the proper welding temperature. In the electric arc process this is accomplished by producing an arc between the work to be welded and an electrode held either in the operator's hand or by a mechanical device. This electrode may be either a carbon rod or a metallic wire.

Carbon Arc

When a carbon rod is used as an electrode, the process is known as carbon arc welding. The heat of the arc melts a small pool in the surface of the work to be welded and this pool is kept molten by playing the arc across it, adding extra metal to form the weld by using filler rod. This type of welding is most applicable where a large amount of heat is required, as in welding heavy sections. Since carbon arc welding is distinctly a puddling process, it cannot be used for overhead work.

Metallic Arc

When a metallic wire is used as the electrode, the process is known as metallic arc welding. The arc developed brings a small portion of the work to the melting point almost instantaneously. The tip of the metallic wire is likewise melted and the globule of molten metal thus formed is carried across the arc and deposited in the molten seat waiting for it in the work. This process is one of deposition because the molten metal formed can be deposited overhead against the force of gravity, thus permitting metallic arc welding to be used in overhead welding, an impossibility by any other known process.

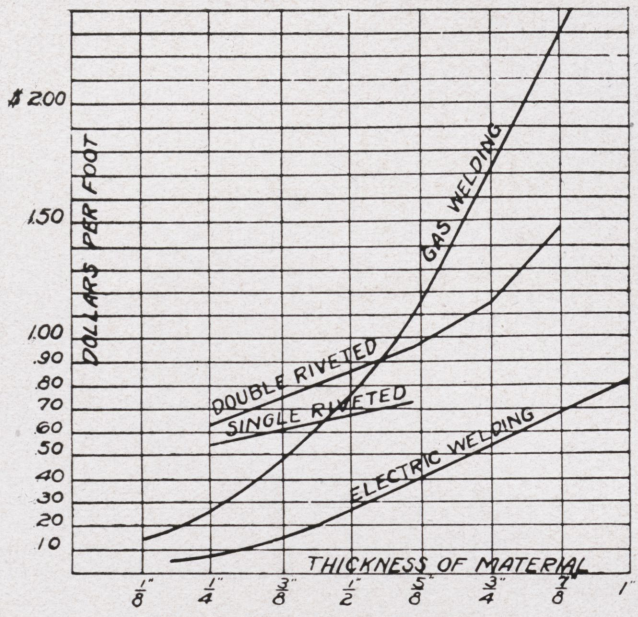


Diagram Shows Comparative Cost.

Reasons for Growth

Electric arc welding has come to the front in such a comparatively short time because of the tremendous saving which it effects in numerous manufacturing industries. Thanks to welding, practically all things formerly made from cast iron can now be made of steel, and steel has many advantages over cast iron, some of the most important of which are:

(1) Cost—Steel costs only ⅓ as much per lb. as cast iron.

(2) Working strength—Steel is approximately 6 times as strong in tension as cast iron.

(3) Stiffness—Steel is 2½ times as stiff as cast iron.

(4) Uniformity—Since steel is more uniform than cast iron, a smaller factor of safety is always used than for cast iron.

One of the principal reasons why cast iron has been used heretofore is because it is easy to cast into any shape but this same reason becomes a disadvantage in the light of steel because of the expense of machining the cast iron casting. This additional cost is eliminated in large part in welded steel where the pieces are of standard steel shapes with the angles accurate enough to require no machine work and the surface already hard finished by rolls.

Cast iron owes its former popularity solely to tradition. Today

(Continued to page 28)

Research and Progress

Conducted by Lee C. Kelsey, m., '32

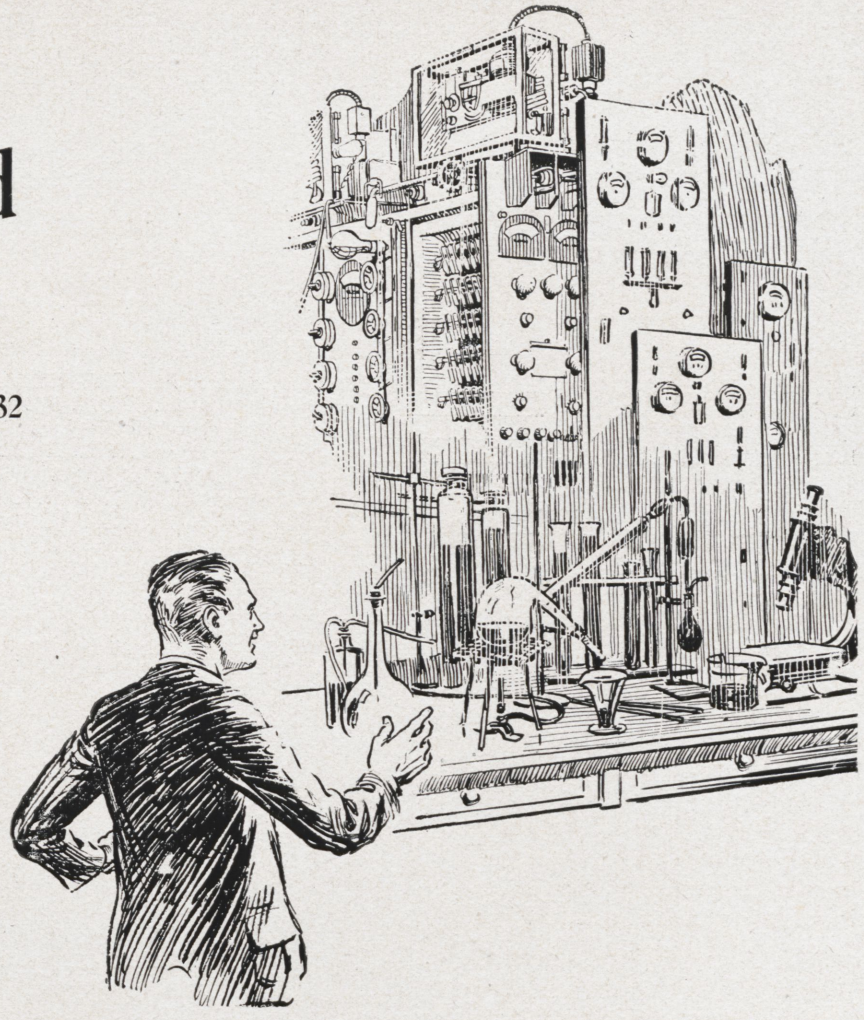
New Bearing Metals

From time to time new bearing metals have been put before the public eye for consideration and trial. Some of these have been very successful and are to be found in our new type, high speed machines over the country.

The newest of these is the self-lubricating bearing. It is estimated that this bearing is much more efficient than the oilless type now in use. Practically all bearings of the oilless type are mounted in motors without lubricant, turn for only a few revolutions and then are idle for a considerable length of time. This type of bearing is found in many of the automobile starter motors. The new bearing can be used with lubricant but in the event that the lubricating supply becomes inadequate it is capable of resisting the heating action of friction for a considerable length of time due to its self-lubricating qualities. When this metal is once placed on a production basis there are some indications that it will revolutionize the construction of bearings wherever they are used. It can be used in typewriters, calculating machines, microscopes, telescopes, etc. or in automobiles, airplanes, steamships and other types of electrical and mechanical apparatus.

World's Largest Roof

The Goodyear Zeppelin Corporation's factory and dock at Akron, Ohio, completed in 1929, was designed and built to construct and house two super-Zeppelins for the United States Navy, each to contain 6,500,000 cubic feet of helium gas. This enormous structure is large enough to house a 10,000,000 cubic foot ship; it would cover two recumbent Washington monuments placed end to end; under its spacious roof an intercollegiate football game and a big league baseball game could proceed simultaneously.



The shape of the hanger was determined only after a careful consideration of wind conditions, since a building that serves as a shelter for lighter-than-air craft must present the least practicable interference with normal wind currents. In mathematical terms, it may be described as being two semi-paraboloids connected by a parabolic cylinder. In other words, sections taken across it form parabolas, and its longitudinal section forms two half parabolas connected by a straight line. This shape has been described as a half egg, but a better simile would be a half of a silkworm's cocoon, cut longitudinally.

The following statistics will probably better show the immensity of this super structure.

Length from center to center of end doors	1,175 ft.
Width from center to center of hinges	325 ft.
Height from center to center of hinges	197 ft. 6 in.
Perimeter of arch	562 ft.
Interior floor area from center to center of door tracks	364,000 sq. ft.
Cubical contents	55,000,000 cu. ft.
Area of roof:	
Shell ... 514,900 sq. ft.	
Doors .. 178,000 sq. ft.	
	693,000 sq. ft.
Reinforced steel:	
Reinforcing bars .. 540 tons	
Rails ... 160 tons	
	700 tons
Skylights	23,000 sq. ft.
Structural steel in doors	1,900 tons
Structural steel in shell and shops	5,500 tons
Total weight of steel	7,400 tons
Approximate weight of roof covering	1,200 tons
Total weight of complete structure	8,800 tons

(Continued to page 30)

Published Monthly by the Students of Rose Polytechnic Institute

The Rose TECHNIC

A Magazine Pertaining to Engineering and Allied Sciences

Member of Engineering College Magazines Associated

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In This Issue

Donald B. Prentice, our president-elect, contributes the leading article in this issue. It is one of great interest to all our readers, both because of the information it contains and because of Dean Prentice's relations with us.

Prof. Alfred T. Child writes an exceedingly interesting paper on the beet sugar industry. He has been absent on leave for a year, traveling in Europe. Consequently he is in a position to compare and make observations on the methods used in this country and in Germany.

Allen G. Stimson again appears in our columns, this time with an article of a scientific nature. It is well written and merits everyone's attention.

Franklin F. Bogardus, an alumnus, contributes to *The Technic* for the first time since his graduation. Much research work has been done recently in the gas meter industry, and Mr. Bogardus is quite active in this field.

Brent C. Jacob, another alumnus, also appears in print in this issue. His article, while somewhat similar to that of Mr. Stimson, deals with the use of the cubical parabola in designing certain types of machinery. This should be of interest especially to mechanicals.

W. Shofner, another newcomer, contributes the paper on electric arc welding. Mr. Shofner has also had experience with his subject, having worked on the laying of a gas pipe line.

Electriitcy?

Does the passage of electricity through a copper wire cause a change in the properties of the metal? Recent experiments point to an affirmative answer. The discovery was made by submerging a live wire and a dead one in an acid solution and measuring the amount of metal dissolved from each piece in a given time. It was found that less copper dissolved from the wire carrying current, either alternating or direct than from the dead wire. Strangely enough, however, when lead, nickle, aluminum, or iron wire was used, the metal was attacked more readily while it was carrying a current.

Encouraged by this discovery, the chemists are continuing their experiments to discover the exact physical and chemical changes caused in a metal by the passage of electricity. Perhaps their work may eventually enable chemists to answer the question scientists have been unable to answer—what is electricity?

Explosives Engineering

Recent uses of explosives have forcibly demonstrated to us the very exactness of the technique involved in the use of such materials. Nearly to the inch can be calculated the position of many structures when moved or destroyed by explosives.

The destruction of smokestacks is now a more or less common work for explosive engineers. The positions of fallen stacks have checked closely with the calculated positions. Dynamite was recently used to blast a grave for a ship previously sunk in New York Bay. The charge was set alongside the sunken ship and after the dynamite had blasted a hole in the sea floor, the ship settled into it. The most recent use of explosives in moving a structure was that startling achievement in Canada in which a dam for a river was constructed on one of the banks and then by a blast of dynamite blown into the river. The desired position of fall for which the charges were set by theoretical calculations was missed by scarcely more than an inch.

We cannot remain unimpressed by these examples of explosives engineering, which has developed into a very scientific work.

Fully loaded, a recently tested Army truck was able to climb a sixty-five per cent grade under its own power.

Engineers of an English railway are experimenting with steel ties, weighing about the same as ordinary oak-wood ties.

Tau Beta Pi

The Rose chapter of Tau Beta Pi, national honorary engineering fraternity, is making a splendid record. Not only are the men belonging to it of the highest caliber, but they also take an interest in student activities and sponsor worthwhile events. The influence of Tau Beta Pi is all to the good.

It should be the aim of every student to achieve the distinction of wearing the Tau Beta Pi key. A person who is a member automatically commands a certain amount of respect in the engineering world. Tau Beta Pi includes the highest grade engineers in the country on its roster.

In striving for this honor do not forget the social and cultural graces. Many people seem to have the idea that culture has no place in the engineer's life. The fallacy of this is easily proved, as no one can be a success without having a certain amount of culture. In fact, one of the requirements of Tau Beta Pi is that the candidate must be a good fellow; and one of its aims is to introduce more of the liberal culture into the engineering schools. So try just a little harder to cultivate extra-curricular activities, and, at the same time, keep your scholastic record high.

The Modulus

As most of our readers know it was decided to publish a Modulus this year. A competent staff has been chosen and is hard at work. Editor-in-chief Hurst promises a fine book and one that will be a credit to the school.

The Modulus used to be a biennial publication. However, due to the Rose Show and to lack of finances, it has been several years since one appeared at the Institute. The best way to make a success of the Modulus is for every student to buy a copy. Do not look upon it as just another book. The Modulus is a record of your Institute and of the days spent there. In days to come how pleasant it will be to leaf through a copy and revive memories of many happy hours spent here.

Let's all help the staff and boost the Modulus.

Alumni

The members of the St. Louis Rose Tech club have unanimously subscribed to *The Technic*. We sincerely appreciate their support and wish that all of the Rose Tech clubs would do as much. *The Technic* is a magazine for the alumni as well as for the undergraduates and we strive to maintain their interest in the publication. We constantly solicit articles from our alumni but do not always meet with success. This month we are honored with a contribution from Mr. Brent C. Jacob. We are extremely grateful to Mr. Jacob and hope that others will follow his example.

Mr. Arthur M. Hood of the class of '93, who is with the Hood & Hahn firm of Indianapolis, sends the following note:

"Both as an alumnus and as one of the first members of the Board of the Rose Technic, I congratulate the staff on the issues this year.

"You are doing a fine piece of work and I enjoy it very much.

"The pen drawings, which I assume are produced by some of the students, are very good and add much to the good literary contents."

Mr. Fred B. Lewis of the class of '05, who is vice-president of the Southern California Edison Co., also sends us a very cordial letter. It follows:

"I want to compliment the Rose Technic Staff on the type of publication it is editing this year.

"In my days of 'Rose', I served three years on *The Technic* staff, and therefore I appreciate the amount of work involved.

"I note that you use attractive illustrations on your cover, and thought perhaps you might desire to use the herewith enclosed photograph which depicts the Southern California Edison Company's Big Creek No. 1 Hydro Plant, of 80,000 kilowatt capacity, and which employs a hydraulic head of 2160 feet. In addition, I think the location is of particular scenic value, located as it is in the High Sierras of California."

The Technic certainly appreciates the wonderful photograph which Mr. Lewis has sent and which appears on the cover of this issue.

Coach Brown

It is with deep regret that we note the illness of Coach Phil Brown. For some time he suffered from appendicitis and finally went to the St. Francis hospital in Indianapolis for an operation. According to the latest reports he is getting along very well, and if not back with us at the time of publication will be back soon.

Basketball

Don T. Spangenberg, m., '31

Rose Basketball Season is in Full Swing.

Rose 19, DePauw 41

Dec. 4, 1930.

Rose Poly opened their basketball season by holding the strong DePauw team to a fairly low score, 41 to 19. The wearers of the Gold started fast and gained a 5 to 0 lead, but field goals by Pacatte and Sawyers and a free throw by Yeager tied the score. Here the DePauw defense tightened and at the half they led the Engineers by a score of 18 to 11. Rose came into the last half stronger than in the first and two field goals and a foul brought the score to 18 to 15. The scant margin was held by DePauw until with about seven minutes to go they shot from all angles and the Engineers were bewildered by their success. The final score was 41 to 19. Eubanks and Ragsdale were the big noise for DePauw while Reinking and Yeager showed promise for the Engineers.

Lineup and Summary:

DEPAUW—41	F. G.	F. T.	P. F.
Ragsdale, f	5	1	1
Moffett, f	4	1	1
Dawalt, f	0	0	0
Perkins, f	0	0	0
Eubanks, c	6	4	1
Copeland, g	0	1	1
Wilson, g	0	0	0
Boswell, g	0	0	1
Graham, g	2	0	2
Totals	17	7	9
ROSE—19			
Pacatte, f	1	0	2
Fisher, f	0	0	1
Reinking, f	2	0	1
Dowen, f	0	0	0
Yeager, c	2	2	3
Sawyers, g	3	1	1
Spangenberg, g	0	0	1
Totals	8	3	9

Referee, Feezle; Umpire, Adams.

Rose 19, Earlham 30

Dec. 6, 1930.

Earlham's fighting Quakers got off to flying start in their initial basketball game of the 1930 season by a 30 to 19 win over Rose Poly. The game started fast with Rose gaining a 6 to 0 lead as the result of three field goals by Sawyers, Reinking, and Yeager. However, Earlham soon tied the score and assumed the upper hand. The half ended 16-10 Earlham. During the second half many substitutions were made by both teams and as a result the game became slower. These Quakers ran the total to 24-10, but in a last minute spurt Rose cut their lead to seven points. Captain Overman was high point man for Earlham and was easily the outstanding man on that team. For Rose, Reinking and Fisher starred on offense with Sawyers and Yeager the best on defense.

Lineup and Summary:

EARLHAM—30	F. G.	F. T.	P. F.
Overman, f	5	1	1
Felix, f	0	0	1
Close, f	0	0	0
Shepler, f	0	0	0
Bowers, c	2	1	0
Schneiderwind, c	1	0	0
Johnson, c	1	0	3
Gaar, g	0	3	1
Maze, g	0	0	1
Powell, g	0	0	1
Stonerock, g	1	1	0
Shamel, g	1	0	1
Totals	12	6	9
ROSE—19			
Pacatte, f	0	0	0
Dowen, f	0	0	2
Reinking, f	4	0	1
Fisher, f	1	1	2
Yeager, c	1	1	1
Hylton, c	0	0	0
Sawyers, g	1	0	0
Griffith, g	0	0	1
Morrison, g	0	0	1
Spangenberg, g	0	3	0
Totals	7	5	8

Referee, Hooker, Butler.

Rose 22, Wabash 35

Dec. 8, 1930.

Rose Poly dropped their third straight game of the season to Wabash by a score of 35 to 22. The Cavemen were playing their first game of the season but showed marked ability to hit the iron ring from the field. At the end of the first half the score was 13 to 12 in their favor, and during the second half this lead was increased. Chase, Bowman, and Howell made baskets in quick succession, and Chase added a charity toss to put Wabash out in front, 20 to 12. Sawyers made a field goal for Rose, but Bowman tipped in two for the upstaters and ran the total to 24 to 12. From here on the Engineers never threatened.

Lineup and Summary:

WABASH—35	F. G.	F. T.	P. F.
Chase, f	3	2	0
Bash, f	0	1	4
Caldwell, f	1	0	0
Johnson, f	0	0	3
Bowman, c	4	6	1
Howell, c	1	0	4
Harting, g	0	0	2
Harmon, g	3	0	4
Henshaw, g	1	0	0
Totals	13	9	18
ROSE—22			
Fisher, f	0	1	1
Pacatte, f	0	0	4
Reinking, f	0	1	2
Dowen, f	0	1	0
Yeager, c	1	3	2
Hylton, c	0	0	0
Morrison, g	0	0	1
Spangenberg, g	0	1	3
Sawyers, g	5	3	1
Griffith, g	0	0	1
Total	6	10	15

Referee, Miller; Umpire Strehmeier

Rose 16, Oak. City 29

Dec. 10, 1930.

The fourth game of the year was dropped in the last half, to Oakland City by a score of 29 to 16. A fast break put Rose out in front at half time 12 to 11, but

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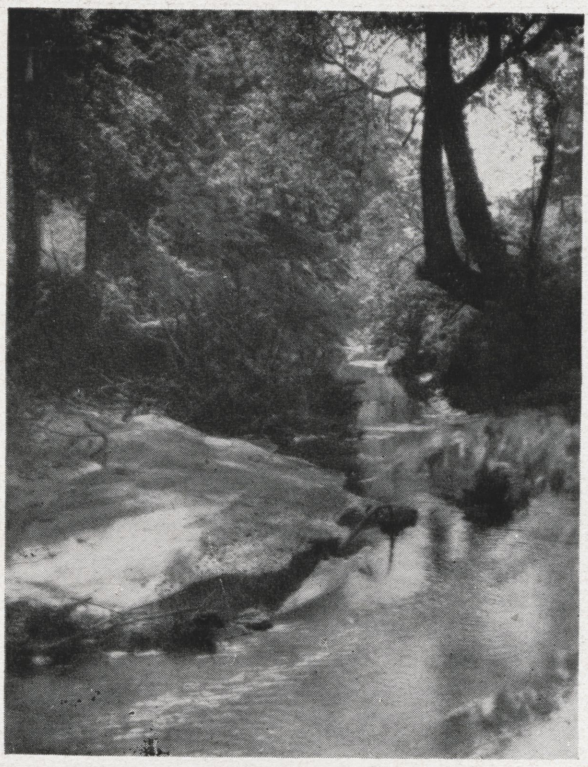
Campus Activities

Robert T. Mees, m., '31



Rose Resumes Work After Christmas Vacation

The Activities Calendar

On November 1 was inaugurated the plan of posting each week an Activities Calendar on the main bulletin board, for the convenience of the students and in order to avoid conflicting meetings and dates. The calendar shows at a glance the time and place of all the activities of each day of the week. Notices of meetings hereafter will be presented to the President's office for official entry on this calendar. The attention of each student is called to the importance of watching the bulletin board for these announcements.

Oscillograph Demonstration

Mr. Archie D. Mac Affer, representative of the General Electric Laboratories, presented an unusually interesting demonstration of the oscillograph, November 19, at Rose Poly. The electrical students, professors, and several local engineers were present.

The oscillograph helps us to learn about things that move, by recording their motion, whether they be heart beats or radio waves. Every one knows that hearts beat, altho few people have seen one beat. Any movement, even if faster than a rifle bullet, that will produce an electrical change can be reproduced on the oscillograph.

A record twenty feet long may be made in a few seconds which has six different relative motions taken simultaneously.

Mr. Mac Affer is conducting a demonstration tour of the important middle west schools. He attempts to show the public the simple operation of the oscillograph, of the new permanent galvanometer type.

A. S. M. E. Meeting

Mr. Bennett, developing engineer of the Columbian Enamelling and Stamping Co., spoke to the student branch of the A. S. M. E. December 16. His subject was "Paths and Prospects", which was of particular interest to the senior students. In his address Mr. Bennett pointed out those things that the graduating engineer must look for, in himself and by himself, so that he will be better able to choose his particular field when he graduates. The electrical students were the guests of the mechanicals at this meeting.

Assemblies

December 4. This regular assembly period was devoted to meetings of the various college activities.

December 11. Judge Fred O. Jeffries of the juvenile court of Vigo county addressed the students, giving examples from his experience in that field and illustrating by several interesting problems of child welfare which had come under his jurisdiction.

December 18. Rev. C. N. Tyndell, rector of St. Stephens Episcopal church, gave a talk on "Religion and Christmas". The Rose Glee club, under the direction of Mr. F. Rechlin, presented four musical selections. The entire program was broadcast over radio station WBOW of Terre Haute.

A. I. E. E. Meeting

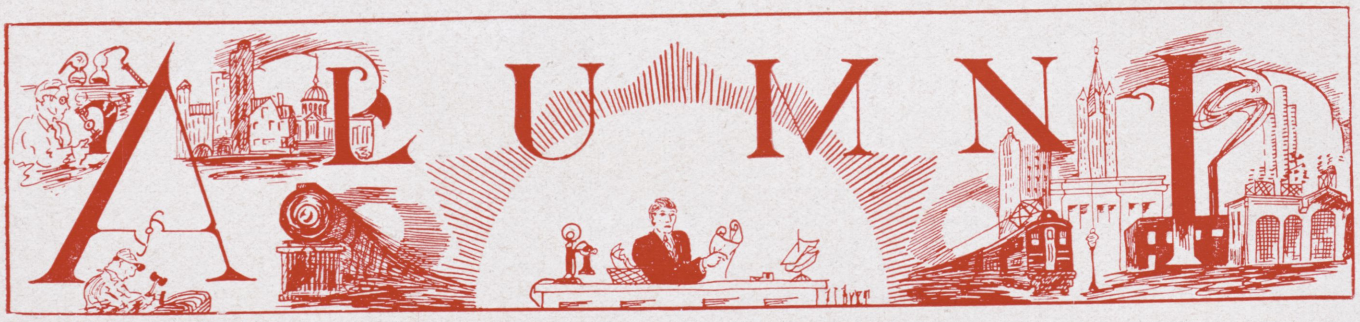
Professor C. C. Knipmeyer was elected chairman of the executive committee on student branch activities at a district meeting of the A. I. E. E. at Chicago, December 1. The section comprises six states of the great lakes district and includes the important engineering schools in Indiana, Michigan, Illinois, Minnesota, Iowa, and Wisconsin. Professor Knipmeyer will attend the national convention of the institute at Toronto, Canada, next fall.

Dorm Dinner

The fifty-two men of Deming hall held their annual Christmas Turkey dinner Thursday, December 18 before the vacation period. Tables were placed in the form of a cross with a Christmas tree at the center.

Donald Kresin, Louisville, was

(Continued to page 29)



L. Herndon Witt, Jr., m., '31

OBITUARY

Mr. Edward Walser, '96, died August 28 at Denver. At the time of his death he was proprietor and manager of the Imperial apartments in Denver.

We also regret to announce the death on Nov. 27 of Mr. James G. Dornbirer. Although not a graduate Mr. Dornbirer has for many years shown great interest in Rose. He was a very active member of the Cleveland Rose Tech club, and he has given to the school various pieces of equipment. All during his life Mr. Dornbirer was interested in machine tools and achieved an enviable reputation by his success in this line. His open side planer brought him world-wide recognition because of its superior qualities.

St. Louis Rose Tech Club

The members of the St. Louis Rose Tech club held a meeting Tuesday, Nov. 25 to celebrate the recovery of their president, Mr. Cale Wamsley, '98, from a serious illness of three months duration. At this meeting Mr. Bareuthers, '10, brought up the question of supporting the Technic. The idea went over 100%, all of the men present subscribing. They resolved that although they were few in numbers they would make up that in increased enthusiasm for Rose Polytechnic. This spirit is very commendable and worthy of emulation by other Tech clubs. The officers of the St. Louis club are Cale Wamsley, '98, president, P. J. Grafe, '20, vice-president, and R. F. Leinberger, '16, secretary-treasurer, all re-elected.

'94 James C. Holding is now the vice-president and general manager of the American Stainless Steel Co. He is located at Pittsburg.

Buckner Speed has become the engineering director of the General Industrial Foundation, New York.

'97 Capt. J. B. Haney, Ordinance Dept. of the United States Army, has been transferred from Raritan Arsenal at Metuchen, N. J. to Chicago.

'98 Harry B. Stiltz has invented and is sponsoring the introduction of the Tornado Carburetor. He is a thermodynamic engineer, living in Philadelphia.

Frank A. Whitten has recently become affiliated with the Bon Bright and Company of Detroit, Mich. as a specialist in public utilities securities.

'00 Sidney J. Kidder is now superintendent of the International Nickel Company at Creighton Mine in Ontario, Canada.

Jesse H. Loofbourrow has become the field engineer with the Miller and Lux Co. Inc., Los Banos, Calif. Formerly he was the assistant engineer with the Uinta Pipe Line Co. of Salt Lake City, Utah.

'03 Dr. S. F. Arnold, ex, is the city physician and councillor for Boston, Mass.

Irving J. Cox has been promoted to the presidency and general managership of the American Glycerine Co., a Du Pont Company, in Wilmington, Del.

Fred N. Rumbley is now vice-president of the Seaboard Midland Petroleum Corporation, Los Angeles, Calif.

'05 Claude E. Robertson is now manager of the mining division for the Westinghouse Electric and Manufacturing Co., Chicago, having been promoted from sales engineer.

Edgar E. Larkins has become recently the superintendent for R. H. Baker Co. Inc., New York.

Dudley D. Wright is with the Central Illinois Public Service Corporation located at Marion, Illinois.

'06 Frank A. Delle is chief engineer of the Refrigerating Co. Inc., Providence, R. I.

Arthur W. Worthington has been promoted to general manager of Limestone Production, Carnegie Steel Co., Pittsburgh.

'07 Wallace P. Andrick has been transferred from the Western Electric Branch to the Bell Telephone Laboratories, New York.

Alonzo D. Schofield, Jr. has been made the district manager for the Henry Vogt Machine Co. at Greenville, S. C.

James R. Stalker has been appointed assistant to the vice-president of the Highway Division of the Truscon Steel Co., Youngstown, Ohio.

'08 Hiram B. Cannon is living a nice quiet life on his farm in Midway, Ky.

Roy H. Jackson is manager of the Fire-King Stoker Co., Evansville, Ind.

'09 Thomas L. Lee has become the vice-president of the Delco Appliance Corporation, Rochester, N. Y.

'10 Orville M. Bercaw is now the general manager of the I. T. E. Circuit Breaker Co., Chicago. Before the change he was with the Cutter Electric and Mfg. Co. of Chicago.

Alfred A. Piper has been transferred from Cincinnati to Chicago by the Electric Controller and Manufacturing Co. With this change also came a promotion to district manager of the Chicago District.

'11 George T. Christopher has been promoted to the position of assistant to the president of the Oakland Motor Car Co., Pontiac, Mich.

David J. Johnson, superintendent of the Mutual Construction Co. of Chicago, returned to Rose Dec. 19 to be initiated into Tau Beta Pi. While arrangements were being made for the initiation he ambled over the school. As he had not been back since the school was at its old location, he was much impressed. He also went through the dormitory and declared it a very splendid one. He is planning to return for the commencement this spring.

James M. Tilley is now with Stone and Webster Engineering Corporation in St. Louis. He was an assistant engineer with the Illinois Central Railroad at Chicago.

'12 William R. Bell has become the general superintendent of the Baton Rouge Electric Co. and of the Steam Products Inc., at Baton Rouge, La.

Donald M. Hubbard has recently become the associate research chemist in the dept. of applied physiology in the University of Cincinnati Medical College. Formerly he was a chemist for Ault and Wiborg Co., Cincinnati.

Oliver E. Reagan is an associate in the firm of Vorhees, Gmelin and Wallace of New York.

'13 Camille C. Baines is district manager for the DeForest Radio Co. in Louisville, Ky.

Harold O. Kelley, superintendent of the Wabash Railway Co. has been transferred from Springfield, Ill. to Peru, Ind.

Claude E. Reese has transferred from the Zenith Radio Co. in Chicago to the Brunswick Radio Corp., Chicago.

Edward A. Scheffel at present is construction superintendent for the G. W. Drach, Inc., Architects, Cincinnati, Ohio.

'14 Hubert B. Deming is operating a Cheverolet agency at Corona, Calif.

Charles F. Harris has started a company of his own in Chicago, The Chas. F. Harris Co. and is its president. His work is construction of deep wells and pump lines.

George E. Schopmeyer has again taken a position with the State Highway Department at E. St. Louis. For some time he was with the W. E. Callahan Construction Co., Dallas, Texas.

'15 Charles N. Stevens is now president and general manager of the Milwaukee Boiler Manufacturing Co., Milwaukee, Wisconsin.

J. Ernest Sheldon is now county engineer for Bay County, Michigan with his headquarters at Bay City, Mich.

'16 Elmer Gadberry is teaching school at the Otter Creek High School, North Terre Haute, Ind.

J. Luther Pirtle is engaged in the electrification of railroads. He is an electrical designer for Gibb and Hill, Inc., New York, N. Y.

'17 M. Harold Smith has become affiliated with the U. S. Lacquer and Chemical Co., St. Louis, Mo.

'18 John W. Mikels, with the Ohio Edison Co. and chief engineer of the Mad River Plant, has been transferred to Youngstown, Ohio.

Robert P. Long, division engineer with the Wabash Railway, has been transferred from Chicago to Moberly, Mo.

Fred W. Springer is a construction engineer with the Allied Engineers, Inc. at Jackson, Mich.

Wayne C. Woodling has become superintendent of the Solite Stoker Co. of Indianapolis.

'21 Joseph T. Ferrell, assistant engineer, with the Brooklyn Edison Co. has enrolled in the Graduate School of Business Administration at New York University.

'22 Robert L. Henderson, acid supervisor, with the DuPont Co. has been transferred from Seneca, Ill. to Gibbstown, N. J.

'23 Arthur W. Griepenstroh has become affiliated with the Cleveland Pneumatic Tool Co. of Cleveland, Ohio.

J. Russel Snyder with the Kentucky Actuarial Bureau has been transferred from Owensboro, to Louisville, Ky.

'24 James H. Brinton has recently become the sales manager of the Electrical Apparatus Department of the Belknap Hardware and Mfg. Co., Louisville, Ky.

Samuel S. Forsythe, branch manager of the Capitol Steel and Iron Co., Amarillo, Texas, has been transferred to Tulsa, Oklahoma.

W. Franklyn Lisman, commercial engineer, with General Electric Co. has been transferred from Cincinnati to Dayton, Ohio.

Frederick W. Schroeder has been made branch manager of the Truscon Steel Co. at Little Rock, Ark.

G. Raymond Fitterer recently obtained his doctor's degree from the University of Pittsburgh, and is continuing his work in the research laboratories of the U. S. Bureau of Mines at Pittsburgh. He is working on the Physical Chemistry of Steel Making.

Floyd E. Watson, gas superintendent, with the Northern Indiana Public Service Co. has been transferred from Argos to Hammond, Ind.

'25 Lester W. Glenn is assistant to the chief engineer of the Florida Citrus Machinery Co., Demedin, Fla.

Henry L. Maury, Jr. has become the superintendent of the Service Oil Co. at Ft. Worth, Texas.

(Continued to page 30)

Fraternities

Kappa of Theta Xi announces with great pleasure the formal initiation of Donald P. Gardner, Terre Haute, Herbert Hylton, Terre Haute, David McEwan, Terre Haute, and Edwin Withers, Brazil, Indiana on the evening of December 15, 1930.

Theta Xi's annual Christmas formal was held in the Vicenza ballroom of the Terre Haute House December 20. Among the guests were Doctor and Mrs. John White, Doctor and Mrs. Clarence P. Sousley, Al Ogan, Don Spangenburg, and Harold Powell. The ballroom was beautifully decorated in holiday colors and attractive favors bearing the crest of the fraternity were given. Warren Henderson and his gaiety Club Entertainers furnished the music for the dancing.

At the first state meeting of the Interfraternity council, Brother Russell V. Smith was elected treasurer for the ensuing term.

Brother Joe Schaack and Brother Herb Hylton were awarded letters for their part in the success of the football team.

Brothers Herb Hylton and Dave McEwan are out for basketball and are really doing some nice work.

One of the most successful meetings of the year was held the evening of December 9. Though the weather was very cold, there was a good attendance. Professor Child gave us a talk on some of his experiences after his graduation. While humorous in places, it gave us a good idea of what one has to expect from the world after school is over. Dr. White talked upon the value of a professional fraternity to an individual. An alumnus of Iota also submitted some of the things with which the unsuspecting senior may come in contact upon graduation.

Much credit is due Brother Blake, who was host for the meeting. A very enjoyable evening was spent by everyone present.

The second annual rabbit hunt was staged on Saturday, December 20, and again was an entire success as far as bagging the game was concerned. Early Saturday morning about fifteen of the brothers gathered at the house and set forth upon their mission. After a full day spent in tramping over the fields and hills, and the firing of enough ammunition to blow up a battleship, they returned, bringing back a considerable number of rabbits that had met their doom. On Sunday, a banquet was held at the house with rabbit and more rabbit disappearing, until a halt was finally called. About all of the brothers were in attendance, with Professor Chinn and Walter Osmer as invited guests.

Albert Ahlers has been elected president of Indiana Gamma for the next year. Other officers elected were Orville Potter, treasurer; William Shofner, scribe; Chester Stock, oracle, and Paul Froeb, chaplain. We have the fullest confidence in the ability of these men to direct the functions of the chapter for the coming year.

Theta Kappa Nu's annual Christmas formal was put over in a big way at the house on the evening of December 26. First class music was furnished by Jack O'Grady and his Varsity Entertainers throughout the evening. Many of the alumni back for the holidays were in attendance as well as a good sized delegation from Indiana Beta at DePauw. The dance was chaperoned by Prof. and Mrs. R. E. Hutchins and Professor Gantz.

The foremost event on the year's social calendar of Indiana Gamma Gamma was the annual Christmas formal dance. It was held in the Vicenza ballroom of the Terre Haute House with Jack O'Grady and his orchestra providing the music. Decorations in the form of balloons and the fraternity colors gave a festive note to the occasion, while the Maltese Cross hanging at one end of the room added the final touch to a perfect dance. Favors consisting of dresser vanity cases on which were mounted an elephant and the A. T. O. crest were presented to

(Continued to page 23)

Beet Sugar in the United States and Germany

(Continued from page 7)

The plant today is thoroughly modern, being of the latest re-enforced concrete construction. A young man whose name was Meyer, a direct descendant of the original family, took us in charge. He had spent several years in the States and spoke perfect English. Not only that but his visit with us, both seeing sugar plants and meeting our people had left a very happy memory with him. Consequently he laid himself out to give us a good time while in Tangermuende.

This plant produces finished sugars of great variety, lump sugars wrapped with customers' names on the wrappers, various grades of granulated, confectioners, and a cheap grade called Kaffir sugar sold in Africa, also beautiful monoclinic crystals packed in boxes and sold chiefly to the Chinese. Right now they have overproduction also. To meet this condition the Meyer & Sohn firm operate a preserve factory nearby as well as a chocolate candy factory. After visiting the refinery we were taken over the candy factory and on leaving were fitted out with generous samples of the candies.

The German Refining Process

The process at Tangermuende is not very different from our own American process, because we have adopted our own methods from German ones. The raw dark brown sugar comes in on canal boats and the railroad. The sugar tests 95% by polarization. This figure is about two per cent high due to high content of ash in the beet sugar. From storage the raw sugar is first washed with hot thin syrup in centrifugals and then dumped into melters where it is converted in dark brown rather dirty looking syrup. The process now splits two ways. In one branch the cheap Kaffir sugar is produced. In this process the heavy juice is treated with ultramarine to decolorize it and then filtered thru special sand and gravel filters under a pressure of 30 pounds to the square inch. The filtered syrup is finished off in the usual way by evaporation in the strike pan and washing in the centrifugals, the same as with us. The sugar is rather grey in tint and sells for a low price to negro trade in Africa.

The other branch produces all the grades of fine sugar. The dark syrup is carefully filtered thru special gravel filters and then completely decolorized in hot bone-char filters. The crystal clear syrup is evaporated down in the strike pans and washed with greatest care to pearly white sugar in the centrifugals. Finally the sugar is finished off in the grades I have mentioned above. In one part of the plant we saw the crystals sold in China being formed on strings suspended in tanks of clear syrup. Everywhere one saw German thoroughness, cleanliness, and order. Everybody seemed to know the chief and everybody touched their hats as we passed. The plant shuts down for lunch and everyone goes to his neat little home.

The Trip Back

After our interesting visit at the candy factory we were taken back by the same limousine to Stendahl where we caught another Cologne express and left the train late in the evening at Dusseldorf. In Dusseldorf I visited the splendid steel research laboratory of the Kaiser Wilhelm Institut and also went over to Muhlheim-Ruhr to visit the Coal Research laboratory of the famous Dr. Franz Fischer. Then we went down the Rhine to Cologne, where we of course saw the famous old cathedral as well as other interesting sights about the picturesque old city. I made a most interesting visit at the great I. G. plant at Leverkusen where the Beyer aspirin is produced as well as vast quantities of dyes, photo film, and acids mostly for their own use. The Sunday before we left was a perfect spring day and we took a marvelous bus ride up the Rhine to the ruins of the famous old robber castle, the Drachenfels. It is situated high above the Rhine on a rocky cliff and commands a wide area of country. The next day we boarded the express for Paris where we remained a number of weeks but as Kipling would say that is another story.

Acknowledgement

The writer wishes to acknowledge the fact that most of the matter for "American Practice" has been obtained from a Bulletin written by Mr. A. L. Genter and published in the proceedings of the Utah Society of Engineers. The flow sheet was adapted from one furnished by the Great Western Sugar Co. of Denver, Colorado.

Basketball

(Continued from page 16)

the lead could not be held and a fast finish by the downstaters turned back the hopes of the Engineers for their first victory of the season. Smith, floor guard, dribbled the entire length of the floor for two baskets and Dunn tossed in three more to keep Oakland City out in front. Although cracking badly near the close of the game, the Rose team showed promise early in the struggle of winning a few games. Sawyers and Fisher both played good games for Rose while Smith and Dunn were best for Oakland City.

Lineup and Summary:

OAKLAND CITY—29	F. G.	F. T.	P. F.
Dunn, f	3	1	4
English, f	0	1	0
Loge, f	2	2	0
Albin, f	0	0	0
Daubenspeck, c	0	0	1
Kilpatrick, c	0	1	0
Smith, g	4	4	2
Holley, g	1	0	1
Powers, g	0	0	0
Totals	10	9	8
ROSE POLY—16			
Fisher, f	2	0	3
Reinking, f	0	0	2
Dowen, f	0	0	1
Pacatte, c	1	1	1
Hylton, c	0	0	0
Yeager, g	0	3	4
Spangenberg, g	0	0	0
Sawyers, g	2	2	1
Richards, g	0	0	1
Totals	5	6	13

Referee, V. Russell.

A better idea of the immensity of the floor space is had when it is remembered that the building covers about 8½ acres.

Fraternities

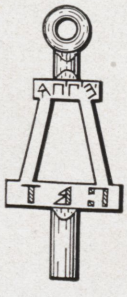
(Continued from page 20)

each guest. Prof. and Mrs. Carl Wischmeyer and Prof. and Mrs. Roland E. Hutchins were chaperons for this wonderful dance. Guests included Floyd Hill and Albert Ogan, Sigma Nu, Harold Powell and Harold Kehoe, Theta Kappa Nu, and Robert Laatz, Theta Xi, as well as brothers from the Indiana and De Pauw chapters. The social committee is to be congratulatetd upon arranging such a successful dance.

Brothers Pratt, Evans, Bruce, Adams, Gillett, and Kruzan, and pledge brother Creedon were awarded sweaters for their splendid work during the past football season. Brother Rockwood earned a sweater as manager of the team. Brothers who are again holding down positions on the basketball team are Captain Sawyers and Spangenberg, and pledge brother Sanford.

The first state interfraternity convention held at Franklin, Dec. 13 was attended by brothers Pratt and Rockwood. They report a successful and enjoyable meeting.

Brother Jacob Maehling was presented with a crested watch chain on Dec. 8 in recognition of his great services to this chapter.



Indiana Beta has just added two new members to its ranks. Mr. Roach of the present senior class was initiated into Tau Beta Pi just before the holidays. Mr. Roach should have been initiated with those who were initiated just before him, but an unfortunate error was made in calculating his scholastic standing. This was soon corrected, however, and he received his bid. The members wish to extend to Mr. Roach their most hearty congratulations, and welcome him into the association.

The chapter is particularly glad also to welcome a new alumnus member, Mr. David J. Johnson of class of 1911.

World's Largest Prover

(Continued from page 10)

cylinder is a pipe which allows air to enter the prover during the upstroke of the piston.

The operations of the various air and hydraulic valves are synchronized so that during the upstroke of the piston preliminary to a test or down stroke the 24 in. rotary air valve opens, admitting air to the prover; and during the down stroke the air valve closes automatically, so that all air forced out by the falling piston passes through the meter being tested. The rate at which the piston drops is regulated by the amount a bleeder hydraulic valve, releasing water from beneath the rod, is opened. This bleeder valve is automatically closed near the end of the stroke to protect the prover from the shock which would ensue if the piston should strike the bottom of the prover.

An electrically operated contactor mounted on the meter synchronizes readings of the meter register with readings on a scale mounted on the piston, which is calibrated to hundredths of a foot stroke. The cylinder diameter being 16 ft. and the working stroke of the piston 14 ft., a volume of 2800 cu. ft. is available for testing.

The meter whose accuracy is to be checked is mounted on the test block adjacent to the prover and the meter inlet connected by air tight piping to the outlet of the prover. Gauges showing the differential pressure across the meter and the static pressure at different points in the system are connected and thermometers installed to indicate any deviation from a constant temperature. The automatic electric contactor is connected to the meter and the piston raised to the top position. By means of a manually controlled hydraulic valve the hydraulic pressure beneath the rod is relieved to allow the piston to fall at the desired rate. As the piston falls, the volume of the cylinder is displaced through the meter, and the volume shown by the meter register, corrected for pressure and temperature, is checked against that indicated by the scale mounted on the piston.

With this type of prover a positive displacement of an accurately predetermined volume is available, the only possible variables being pressure and temperature, which can be easily checked and corrected for. This volume is that of a cylinder whose diameter can be checked by means of a government certified pin gauge and whose height can be checked by means of the government certified scale mounted on the piston.

The recording devices are operated automatically, which eliminates all possible errors due to manually operated recorders.

Gas engineers who have visited the prover and watched its operation are enthusiastic in their approval of this new standard and feel that it is the most accurate device available for testing gas meters. The largest meters commonly used in this country can be checked at their maximum capacity, something which has heretofore been impossible. It is generally conceded that a new code should be laid down regarding the checking of meters, because of the increase in the great amount of gas being used for industrial purposes and the development of new metering devices which can not be accurately calibrated by existing methods. Those who have developed the 2800 cu. ft. prover feel that it provides a basis on which an up-to-date code can be worked out.

Engineering Education

(Continued from page 5)

and chemists would rank high in natural science, but because of the large amount of time devoted to the engineering subjects in a technical curriculum, low scores in literature and social science would be in order.

However, the ranking of these nine groups by total scores was as follows:

1 Chemistry
2 Engineering
3 Mathematics
4 English
5 History
6 French
7 Economics
8 Education
9 Household Arts

The relative average concentration of study in the major fields

is given by the following table:

		Credit hours
1	Engineering	78
2	Economics	59
3	Household Arts	47
4	Chemistry	33
5	English	31
6	Education	29
7	Mathematics	27
8	French	26
9	History	26

In spite of the fact that more than half the college course for the engineers was devoted to professional subjects and many more hours to the fundamental sciences, the seniors possessed a breadth of knowledge sufficient to score much higher in fields not their own than the arts men were able to do. And if this remarkable record is due in part to superior native ability, we may still be quite as proud of the next generation of engineers.

The Cubic Parabola

(Continued from page 11)

go inside it, and if it is not convenient to make such a drawing, the following method of figuring will show if any part of a tapered shaft is weaker than it is at R when subject to a bending WL.

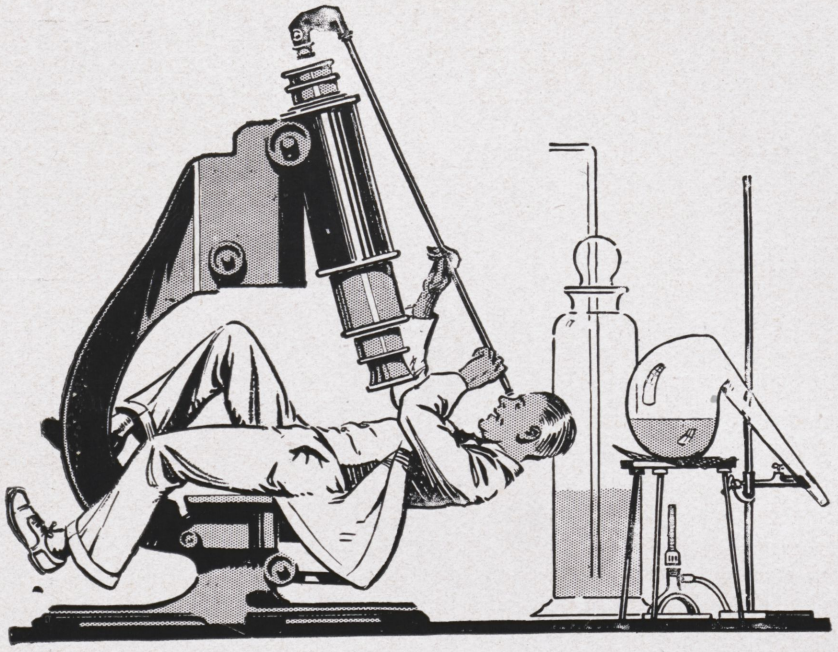
Referring to Fig. 1, line (3) (4) is drawn parallel to line (1) (2) and tangent to the cubical parabola $r^3=R^3\frac{l}{L}$. Actually no lines are drawn but are shown here for explanation The slope of the line (1 ,2) is $(R-a)\div c$ and by construction equals $\frac{dr}{dl}$ the slope of line (3) (4). Differentiating $r^3=R^3\frac{l}{L}$ gives $3r^2\,dr=\frac{R^3}{L}dl$ $\therefore\frac{dr}{dl}=\frac{R^3}{3r^2L}=\frac{R-a}{c}$ from which $r=\sqrt{\frac{cR^3}{3L(R-a)}}$. With r found thus, l is gotten from the equation $l=\frac{r^3L}{R^3}$. The value of r′ at the point l is a+e, where $e=\frac{l-b}{c}(R-a)$. If r′ is larger than r, the shaft has no weak spot, but the taper is wrong and the shaft is weaker than at R if r′ is smaller than r.

An example will show the numerical values, in which $R=5\frac{1}{2}''$, $a=3\frac{1}{2}''$, $b=4''$, $C=76''$, & $L=86''$

$$r=\sqrt{\frac{cR^3}{3L(R-a)}}=\sqrt{\frac{16\times5\frac{1}{2}^3}{3\times86(5\frac{1}{2}-3\frac{1}{2})}}$$

(Continued to page 28)

Unapplied Mechanics



The Final Examinations, January 26-31.

Have you heard the Aspirin story, the one about the three Bayers?

—Sun Dial

CANDY

Come on in and take a seat.
If you've some dough, no doubt you'll eat,
But if you're broke you'll sit and loaf,
And talk to all the girls, you oaf.

You put your feet upon the chairs,
And give the waiters all gray hairs.
You never spend a dime, you bloke.
It's a wonder poor old Gillis ain't broke.

You never go to school at all,
You only come in here to loll.
I don't believe you ever think,
'Cause it would put you on the blink.

If you can bum a ride you will,
You stick your fingers in the till.
If you weren't here we'd all have seats.
When we come in to get our eats.

—Frank Smith

Olaf's City Cousin—"Goodness, these new skirts are so tight around the bottom I can hardly navigate."

"I noticed that", Olaf replied, "and they seem pretty tight around the ankles, too."

—Whiz Bang

Tourist (in Yellowstone Park): "Those Indians surely have a blood-curdling yell."

Guide: "Yes, everyone of them is a college graduate."

—Boston Transcript

Rhodes Scholar: "And poor Williams was killed by a revolving crane."

Englishwoman: "H e a v e n s ! What fierce birds you have in America."

—Texas Ranger

"Prisoner, if you didn't steal the $3,000—where did you get it?"

"Yer honor, I saved it from buying Listerine tooth paste."

—Sour Owl

First Beta: "There goes Addaline."

Second Nut: "Who? That's Pearl Smith."

First: "Yeah."

Second: "Why call her Addaline."

First: "Her initials are P. S.

—The Siren

"How could you tell that Mrs. Murfey had a set of false teeth?"

"Oh, it just came out in the conversation."

—Sun Dial

Gypsy—"I tella your fortune, mister."

Stude—"How much?"

Gypsy—"Twenty-five cents."

Stude—"Correct. Howdja guess it?" *—Okla. Whirlwind*

Judge—"Were you alone when you were robbed?"

Chicagoan—"No, sir; there was a big policeman being robbed at the same time."

—Arizona Kitty Kat

Yeah, the war cost Sandy his arm. He couldn't bring himself to throw away a grenade.

—V. M. I. Sniper

Pledge (at dinner table)—"Must I eat this egg?"

Brother—"Yer damn right."

Silence— .....

Pledge—"The beak too?"

—Arizona Kitty Kat

Doctor—"Congratulations, professor, it's a boy."

Absentminded Prof.—"What is?" *—Boston Bean Pot*

Landlady—"I think you had better board elsewhere."

Collegian—"Yes, I often had."

Landlady—"Had what?"

Collegian—"Better board elsewhere." *—Lehigh Birr*

Registrar—"Name, please."

Frosh—"Whose?"

—U. of S. C. Wampus

Editor's wife—"John! Little Billy just split our neighbor's skull with an axe."

Tabloid editor—"Don't talk shop." *—C. C. N. Y. Mercury*

"I was out with the most marvelous fraternity man last night, and he had the grandest pin."

"That wasn't a fraternity man; that was a deputy sheriff."

—Ollapod

Why is it that we always hear about the girl who walked home and never a word about the one who rode home? *—Ollapod*

Book Reviews

Human Nature and Management

By Ordway Tead

A splendid text on the application of psychology to executive leadership is found in Ordway Teads' "Human Nature and Management." The book is intended to give a working knowledge of psychology which will enable the executive better to predict and control human behavior.

The author states that the book was written with three objectives in view. First, to present the essentials of modern psychology and show its application to human relations. Second, to help the reader improve the conduct of his own mental life. Third, to show tested psychological methods for managing people.

This book is of great value not only to the executive but to everyone engaged in business. It gives to the reader a greater appreciation of the art of management.

Mr. Ordway Tead is the lecturer on personnel administration at Columbia University. Some of his other books are Instincts in Industry, The People's Part in Peace, A Course in Personnel Administration, and Personnel Administration.

The first ten chapters consist of a popular but scientifically sound synopsis of psychological principles. The remainder of the book presents specific applications of these principles which are actual experiences of successful executives. The library of no engineer or business man is complete without "Human Nature and Management."

McGraw-Hill Book Co. $3.50

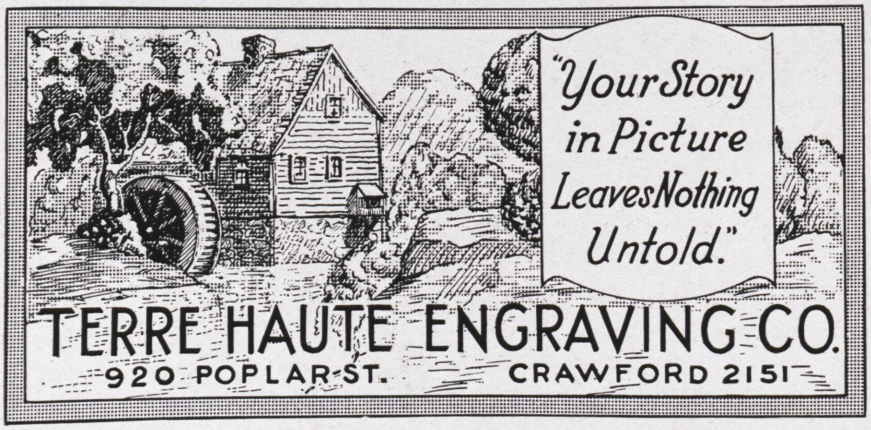
The Technique of Executive Control

The Technique of Executive Control is an excellent treatise on the art of industrial leadership. The author is well qualified to write such a book for he is the professor of Business Administration at Massachusetts Institute of Technology.

The text analyses the characteristics which are essential to the successful executive. Each is defined and discussed and illustrative examples are given. Comprehensive questions and exercises help to fix the principles in the readers' mind. After analysing the qualities which the executive should possess the author sets forth concrete methods of dealing with associates and securing maximum cooperation within the organization.

The book is divided into eight chapters. First, is the introductory which states the fundamental principles. Second, executive tools and their use are discussed. Third, the devices of executive control are outlined. Fourth, it is shown how the executive can stimulate others by psychological methods. Fifth, the duties of the executive are analysed. The last three chap-

(Continued to page 30)



The Cubic Parabola

(Continued from page 25)

$=\sqrt{24.5}=4.95''$ $l=\frac{r^3L}{R^3}=\frac{4.95^3\times56}{5.53}$ $=62.8$ $e=\frac{l-b}{c}(R-a)=\frac{62.8-4}{76}(5\frac{1}{2}-3\frac{1}{2})=\frac{58.8}{76}\times2=1.55''$ $r'=a+e=3.5+1.55=5.05''$.

As $r'=5.05''$ is greater than $r=4.95''$, the shaft has no weak point.

The size of the end of radius, a, is usually determined by shear value of the load W and bearing value at this support.

Pillar cranes usually have a hollow cast pillar with its shape to give equal strength due to side bending. The over turning moment due to live and dead load gives the bending moment on the bottom section and the outside radius R and inside radius R′ can be figured with the allowable fiber stress. Using the slide rule method shown in Fig. 2, the outside radii are obtained from the O-R sloping line and the inside radii from the O-R′ sloping line. The bottom part of this casting is usually flared out for the holding down bolts and the upper part is thickened up to hold the top pin. The picture Fig. 4 shows such a crane.

The deflection of a cantilevered shaft, L inches long, 2R inches diameter at the support, and w pounds per cubic inch due to bending from its own weight, equals $\frac{1}{2}\frac{wL^4}{ER^2}$ for a shaft of uniform section and equals $\frac{27}{100}\frac{wL^4}{ER^2}$ for a shaft shaped to a cubical parabola. The deflection due only to a load W pounds at its extremity is $\frac{4WL^3}{3\pi R^4E}$ for the uniform section and equals $\frac{12WL^3}{5\pi R^4E}$ for the cubical parabola or 1.8 times as much as the uniform shaft. The deflection due to shear has been neglected in the above calculations.

Electric Arc Welding

(Continued from page 12)

with hundreds of examples in welded steel before us there is no logical reason for clinging to the old designs which were necessary because of limitations of the casting process, and as a result the redesigning of products for arc welded steel construction is on the increase.

Field

One might say there is an almost unlimited field in which arc welding can be applied profitably. It has been and still is being used successfully in the making of all kinds of bases, covers, containers, lathes, etc. In fact arc welding may be applied wherever steel can be used. Electric arc welded steel buildings are becoming numerous enough to require building inspectors to educate themselves in the elementary and fundamental principles. It is even being used in ship and aeroplane construction, although in these latter applications there is much still to be accomplished.

In the opinion of the author, the influence of electric arc welding is just becoming felt and is destined to revolutionize the iron and steel industry. That manufacturer will profit most who is the first to realize its possibilities and apply them to his particular industry.

Campus Activities

(Continued from page 17)

toastmaster and very wittily did he introduce several of the students for short talks after the dinner. Max Eyerman was Santa Claus and distributed over a bushel of gifts to the students and guests. Many comical gifts were opened before the entire group and a most pleasant evening was soon gone. The guests were: Mr. and Mrs. Hopkins, Miss Gilbert, Miss Barbara Pinnell, and Miss Sarah Ann Wiley.

Five formal dances were held by the Rose fraternities and the military department this Christmas season. Four of these were held before the holiday vacation. The outstanding dance was the Military Ball, December 18, which was possibly the most gorgeous of formal affairs of the year in Terre Haute. Over 200 couples attended. The dance was held in the Rose gym which was decorated beautifully with miles of colored paper streamers and representative flags of the military department. Jack Chapman and his Victor recording orchestra entertained from 9 to 1 o'clock.

Alumni

(Continued from page 19)

'26 Victor E. Schlossberg has been promoted to assistant electrical superintendent with the Inland Steel Co. at East Chicago, Ill.

Joseph H. Utt is with the Allied Engineers, Inc., at Grand Rapids, Mich. Before this change he was with the Stevens-Wood Inc., at Jackson, Mich.

D. Ralph Werner with the A. T. & T. Co. has been transferred from Davenport, Iowa to Chicago.

Baldwin G. Witty has been transferred from Schenectady to Chicago by the General Electric Co.

'28 Claude C. Cash, in the A. T. & T. development and research department has been transferred from Lynn, Mass. to New York.

Guy S. Mahan has been promoted to the splendid position of chief engineer of the electrical department for the Hudson Motor Co. at Detroit.

Robert A. Thompson, with the Dravo Contracting Co., Indianapolis, has been sent to Detroit.

Wallace K. Todd in the sales and service dept. of the Koppers Seaboard Coke Co. at Pittsburgh, Pa. has been transferred to Jamaica, N. Y.

Benj. H. Van Vactor has become affiliated with the Philadelphia and Reading Coal and Iron Co. at Pottsville, Pa. as assistant mechanical engineer.

'29 John A. Derry, substation inspector for the Pennsylvania R. R. at Brunswick, N. J., has been transferred to Philadelphia.

Herschel E. Hylton, a student engineer with The Doherty Co., is now located at Great Bend, Kansas where he will remain until April 1.

Emil A. Krockenberger is now a research fellow at Carnegie Tech. in Pittsburgh.

Henry T. Nancrede is doing field work for L. A. Snider Engineering Service. At present Nancrede is in Springfield, Ill. L. A. Snider, president of the L. A. Snider Engineering Service, Inc., is a Rose graduate of the class of 1905.

Carl G. Planck is superintendent of schools at Haines City, Florida.

Research and Progress

(Continued from page 13)

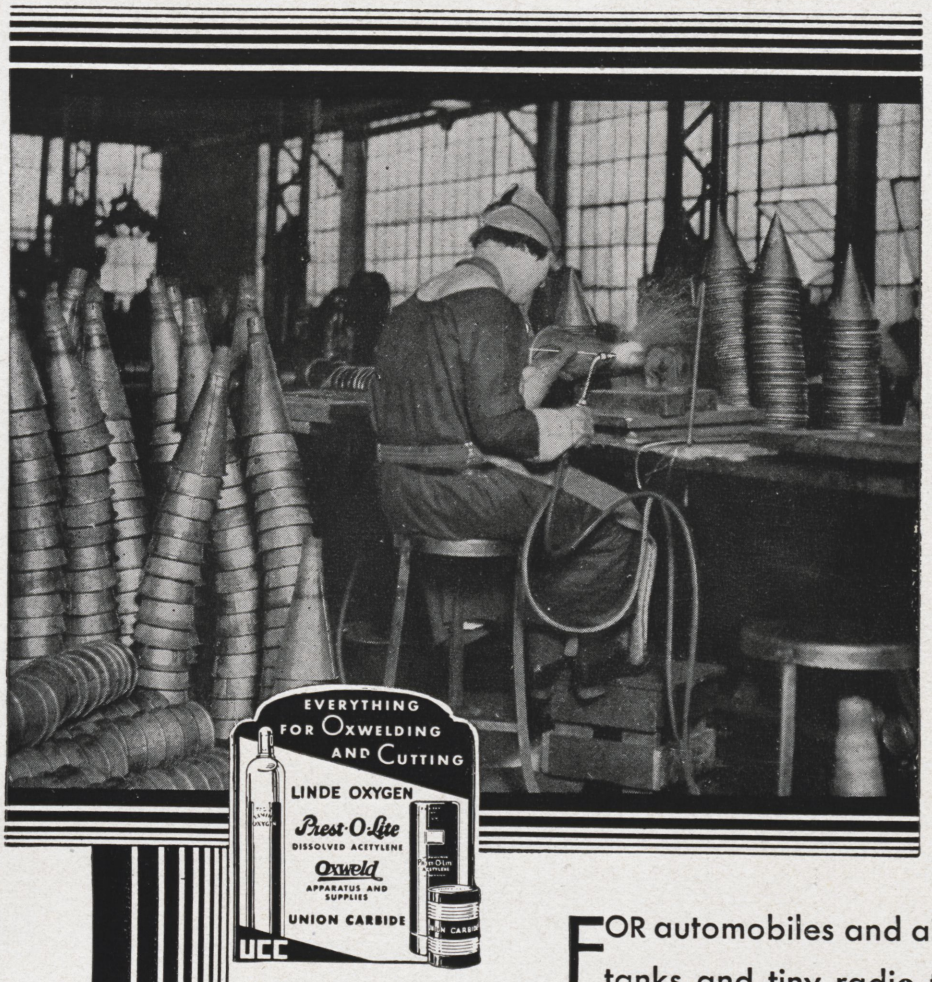
Concrete foundations and floors .....15,200 cu. yd.
Number of piles (each about 25 ft. long) 1,300
Weight of one door leaf.....609 tons
Construction period.....14 months
Earth handled in preparation of 60 acre site.....1,000,000 cu. yd.

Book Reviews

(Continued from page 27)

ters are devoted to a study of personal relations with subordinates, associates, and superiors in which are given methods of securing greater cooperation and efficiency.

McGraw-Hill Book Co. 171 *pages*, 5x8, $2.00.



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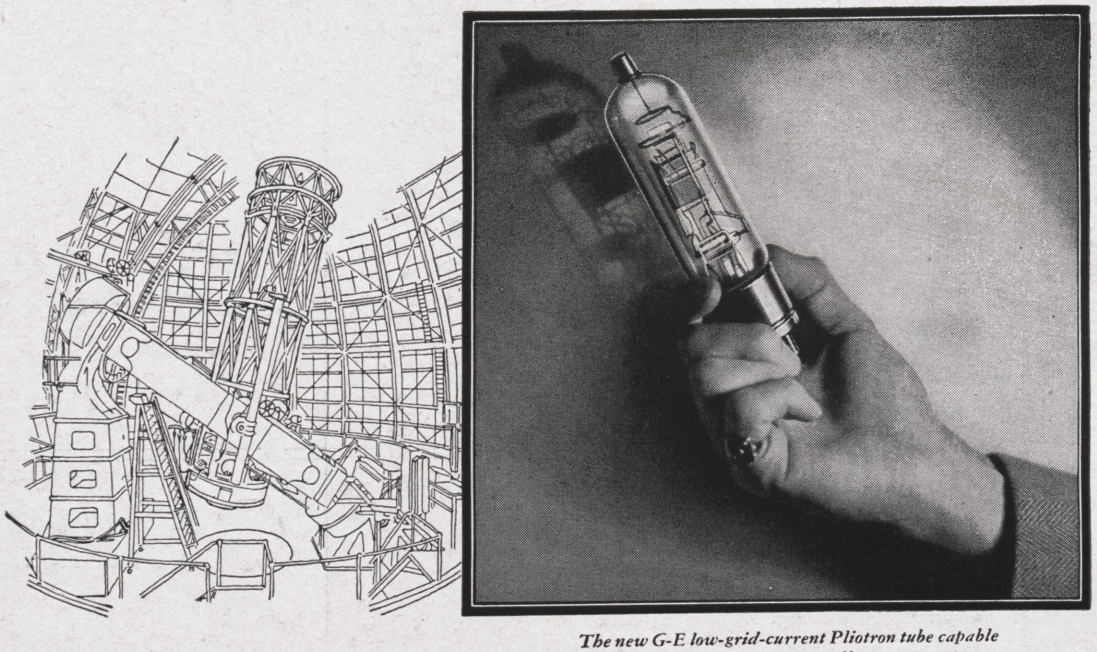

The new G-E low-grid-current Pliotron tube capable of measuring a current as small as 10^{-17} ampere

This Little Tube Measures Stars Centuries of Light Years Distant

BY MEANS of a new vacuum tube called a low-grid-current Pliotron tube, astronomers can gather the facts of stellar news with greater speed and accuracy. In conjunction with a photoelectric tube, it will help render information on the amount of light radiation and position of stars centuries of light years away. It is further applicable to such laboratory uses as demand the most delicate measurement of electric current.

So sensitive is this tube, that it can measure 0.000,000,000,000,000,01 of an ampere, or, one-hundredth of a millionth of a billionth of an ampere. This amount of current, compared with that of a 50-watt incandescent lamp, is as two drops of water compared with the entire volume of water spilled over Niagara Falls in a year.

General Electric leadership in the development of vacuum tubes has largely been maintained by college-trained men, just as college-trained men are largely responsible for the impressive progress made by General Electric in other fields of research and engineering.

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